SRI V. S. SIVALINGAM CHETTIAR GOVERNMENT DEGREE COLLEGE (A)

Department of Physics

B.Sc. Honours with Research in Physics (2024 Batch)

Student Research Projects Report

As part of the B.Sc. Honours with Research in Physics curriculum, the 2024 batch students successfully completed their research-based project work integrating Physics concepts, Machine Learning, Deep Learning, and Data Science techniques. The projects were designed to strengthen students' interdisciplinary research skills, problem-solving ability, computational knowledge, and application of physics principles to real-world challenges.

The students selected contemporary research themes covering image compression, stress detection, air quality monitoring, weather forecasting, stock market trend analysis, solar radiation prediction, and cloud-based high-frequency intelligent systems.

These projects demonstrate the department's emphasis on outcome-based education, research exposure, innovation, and emerging technologies in physics applications.

1. List of Student Research Project Titles

The following research projects were completed and submitted by the 2024 batch students:

1. CNN-Based Interval Arithmetic Vector Quantization for Image Compression
2. The Study of Physics-Based Techniques and Machine Learning to Identify Stress in Specific Work Environments
3. An Immersive Model for Detecting Air Quality Using Physics Technique and Machine Learning Approach
4. Weather Forecasting Using Physics and Deep Learning Techniques
5. Prediction of Stock Market Status Using Physics and Machinery Methodology
6. Solar Radiation Prediction Using Machine Learning
7. Intelligent Backup of High Frequency Using Data File in Cloud Storage

2. Research Objectives

The major objectives of the project work were:

- To promote research aptitude among undergraduate physics students.
- To apply physics principles in computational and real-time systems.
- To introduce students to Machine Learning, CNN, and Deep Learning models.
- To encourage data-driven prediction and intelligent modeling techniques.
- To develop interdisciplinary understanding between Physics and Computer Science applications.
- To enhance scientific writing, data analysis, and project presentation skills.

3. Methodology Adopted

The students followed a structured research methodology consisting of:

- Literature survey on recent advances in physics-based AI applications.
- Problem identification and selection of real-world datasets.
- Data preprocessing and normalization.
- Model development using Machine Learning / Deep Learning techniques.
- Physics-based parameter analysis wherever applicable.
- Training, testing, and validation of predictive models.
- Result analysis using performance metrics.
- Report writing and viva-voce presentation.

Tools and platforms used included:

- Python
- TensorFlow / Keras
- MATLAB (where required)
- Google Colab / Jupyter Notebook

- Cloud storage tools
- Public environmental and financial datasets

4. Project-Wise Academic Relevance

4.1 Image Compression Using CNN

This project explored Convolutional Neural Networks (CNNs) and vector quantization methods for efficient image compression. It introduced students to signal processing, computational physics, and image optimization techniques.

4.2 Stress Identification in Work Environments

Students investigated stress detection using sensor-based physical parameters and machine learning models, connecting biophysical measurements with intelligent classification systems.

4.3 Air Quality Detection

This project focused on environmental physics, sensor data, and ML models to estimate air pollution parameters, supporting real-time environmental monitoring.

4.4 Weather Forecasting

The students applied atmospheric physics concepts and deep learning techniques to predict weather parameters such as temperature, humidity, and rainfall trends.

4.5 Stock Market Status Prediction

Though interdisciplinary, this project introduced time-series analysis, mathematical physics-inspired modeling, and predictive AI methods.

4.6 Solar Radiation Prediction

This project has strong relevance to renewable energy physics, where students used ML algorithms to forecast solar radiation intensity for energy applications.

4.7 Intelligent Cloud Backup System

This project focused on high-frequency data handling, storage optimization, and cloud-based intelligent backup techniques, exposing students to advanced data systems.

5. Learning Outcomes Achieved

Through the completion of these projects, students were able to:

- Understand the research methodology process.
- Gain practical knowledge in AI/ML model development.
- Apply physics concepts to real-life computational problems.
- Improve coding, simulation, and data analysis skills.
- Develop technical report writing and presentation competence.
- Enhance their readiness for higher studies, internships, and research careers.